CLAIMS

What is claimed is:

1. A wavelength division multiplexing device comprising:

a polymer collimating lens for collimating a plurality of monochromatic optical beams;

a diffraction grating for combining the plurality of collimated, monochromatic optical beams into a multiplexed, polychromatic optical beam; and

a polymer focusing lens for focusing the multiplexed, polychromatic optical beam.

2. The device as defined in claim 1, wherein the diffraction grating is a transmissive diffraction grating.

3. The device as defined in claim 2, further comprising:

a transmissive element associated with the transmissive diffraction grating, the transmissive element having at least one reflective surface for reflecting the multiplexed, polychromatic optical beam.

4. The device as defined in claim 2, further comprising:

a transmissive element associated with the transmissive diffraction grating, the transmissive element having at least one reflective surface for reflecting the plurality of collimated, monochromatic optical beams.

5. The device as defined in claim 1, wherein the polymer collimating lens and the polymer focusing lens operate in the infrared region of the electromagnetic spectrum.

6. The device as defined in claim 1, wherein at least one of the polymer collimating lens and the polymer focusing lens is a plano-convex lens or a convex-plano lens.

7. The device as defined in claim 1, wherein at least one of the polymer collimating lens and the polymer focusing lens is a bi-convex lens.

8. The device as defined in claim 1, wherein at least one of the polymer collimating lens and the polymer focusing lens is a spherical lens.

9. The device as defined in claim 1, wherein at least one of the polymer collimating lens and the polymer focusing lens is an aspherical lens.

10. The device as defined in claim 1, wherein the polymer collimating lens and the polymer focusing lens are formed of a polymer material selected from the group consisting of acrylic, styrene, polycarbonate, copolymers thereof, and other polymer materials that efficiently transmit optical beams in the infrared region of the electromagnetic spectrum.

11. An integrated wavelength division multiplexing device comprising:

a polymer collimating lens for collimating a plurality of monochromatic optical beams;

a boot lens affixed to the polymer collimating lens for transmitting the plurality of collimated, monochromatic optical beams from the polymer collimating lens, the boot lens having a planar exit surface; and

a diffraction grating formed at the planar exit surface of the boot lens for combining the plurality of collimated, monochromatic optical beams into a multiplexed, polychromatic optical beam.

12. The device as defined in claim 11, wherein the boot lens is incorporated into the polymer collimating lens such that the polymer collimating lens has the planar exit surface at which the diffraction grating is formed.

13. The device as defined in claim 11, wherein the boot lens is a first boot lens, the device further comprising:

a second boot lens affixed to the polymer collimating lens for transmitting the plurality of monochromatic optical beams to the polymer collimating lens.

14. The device as defined in claim 13, wherein the second boot lens has a planar entry surface for accepting the plurality of monochromatic optical beams from at least one optical source.

15. The device as defined in claim 11, wherein the polymer collimating lens has a planar entry surface for accepting the plurality of monochromatic optical beams from at least one optical source.

16. The device as defined in claim 11, wherein the diffraction grating is a transmissive diffraction grating.

17. The device as defined in claim 16, further comprising:

a transmissive element associated with the transmissive diffraction grating, the transmissive element having at least one reflective surface for reflecting the multiplexed, polychromatic optical beam.

18. The device as defined in claim 17, wherein the boot lens is a first boot lens, the device further comprising:

a second boot lens affixed to the transmissive element for transmitting the multiplexed, polychromatic optical beam from the transmissive element; and

a polymer focusing lens affixed to the second boot lens for focusing the multiplexed, polychromatic optical beam.

19. The device as defined in claim 18, wherein the second boot lens is incorporated into the polymer focusing lens such that the polymer focusing lens is affixed to the transmissive element.

20. The device as defined in claim 18, further comprising:

a third boot lens affixed to the polymer focusing lens for transmitting the focused, multiplexed, polychromatic optical beam from the polymer focusing lens.

21. The device as defined in claim 20, wherein the third boot lens has a planar exit surface for outputting the focused, multiplexed, polychromatic optical beam to at least one optical receiver.

22. The device as defined in claim 18, wherein the polymer focusing lens has a planar exit surface for outputting the focused, multiplexed, polychromatic optical beam to at least one optical receiver.

23. An integrated wavelength division multiplexing device comprising:

a polymer focusing lens for focusing a multiplexed, polychromatic optical beam;

a boot lens affixed to the polymer focusing lens for transmitting the multiplexed, polychromatic optical beam to the polymer focusing lens, the boot lens having a planar entry surface; and

a diffraction grating formed at the planar entry surface of the boot lens for combining a plurality of monochromatic optical beams into the multiplexed, polychromatic optical beam.

24. The device as defined in claim 23, wherein the boot lens is incorporated into the polymer focusing lens such

that the polymer focusing lens has the planar entry surface at which the diffraction grating is formed.

25. The device as defined in claim 23, wherein the diffraction grating is a transmissive diffraction grating.

26. The device as defined in claim 25, further comprising:

a transmissive element associated with the transmissive diffraction grating, the transmissive element having at least one reflective surface for reflecting the plurality of monochromatic optical beams toward the transmissive diffraction grating.

27. The device as defined in claim 26, wherein the boot lens is a first boot lens, the device further comprising:

a second boot lens affixed to the transmissive element for transmitting the plurality of monochromatic optical beams to the transmissive element; and

a polymer collimating lens affixed to the second boot lens for collimating the plurality of monochromatic optical beams prior to transmission by the second boot lens.

28. The device as defined in claim 27, wherein the second boot lens is incorporated into the polymer collimating lens such that the polymer collimating lens is affixed to the transmissive element.

29. A wavelength division demultiplexing device comprising:

a polymer collimating lens for collimating a multiplexed, polychromatic optical beam;

a diffraction grating for separating the collimated, multiplexed, polychromatic optical beam into a plurality of monochromatic optical beams; and

a polymer focusing lens for focusing the plurality of monochromatic optical beams.

30. The device as defined in claim 29, wherein the diffraction grating is a transmissive diffraction grating.

31. The device as defined in claim 30, further comprising:

a transmissive element associated with the transmissive diffraction grating, the transmissive element having at

least one reflective surface for reflecting the collimated, multiplexed, polychromatic optical beam.

32. The device as defined in claim 30, further comprising:

a transmissive element associated with the transmissive diffraction grating, the transmissive element having at least one reflective surface for reflecting the plurality of monochromatic optical beams.

33. The device as defined in claim 29, wherein the polymer collimating lens and the polymer focusing lens operate in the infrared region of the electromagnetic spectrum.

34. The device as defined in claim 29, wherein at least one of the polymer collimating lens and the polymer focusing lens is a plano-convex lens or a convex-plano lens.

35. The device as defined in claim 29, wherein at least one of the polymer collimating lens and the polymer focusing lens is a bi-convex lens.

36. The device as defined in claim 29, wherein at least one of the polymer collimating lens and the polymer focusing lens is a spherical lens.

37. The device as defined in claim 29, wherein at least one of the polymer collimating lens and the polymer focusing lens is an aspherical lens.

38. The device as defined in claim 29, wherein the polymer collimating lens and the polymer focusing lens are formed of a polymer material selected from the group consisting of acrylic, styrene, polycarbonate, copolymers thereof, and other polymer materials that efficiently transmit optical beams in the infrared region of the electromagnetic spectrum.

39. An integrated wavelength division demultiplexing device comprising:

a polymer collimating lens for collimating a multiplexed, polychromatic optical beam;

a boot lens affixed to the polymer collimating lens for transmitting the collimated, multiplexed, polychromatic optical beam from the polymer collimating lens, the boot lens having a planar exit surface; and

a diffraction grating formed at the planar exit surface of the boot lens for separating the collimated, multiplexed, polychromatic optical beam into a plurality of monochromatic optical beams.

40. The device as defined in claim 39, wherein the boot lens is incorporated into the polymer collimating lens such that the polymer collimating lens has the planar exit surface at which the diffraction grating is formed.

41. The device as defined in claim 39, wherein the boot lens is a first boot lens, the device further comprising:

a second boot lens affixed to the polymer collimating lens for transmitting the multiplexed, polychromatic optical beam to the polymer collimating lens.

42. The device as defined in claim 41, wherein the second boot lens has a planar entry surface for accepting the multiplexed, polychromatic optical beam from at least one optical source.

43. The device as defined in claim 39, wherein the polymer collimating lens has a planar entry surface for accepting the multiplexed, polychromatic optical beam from at least one optical source.

44. The device as defined in claim 39, wherein the diffraction grating is a transmissive diffraction grating.

45. The device as defined in claim 44, further comprising:

a transmissive element associated with the transmissive diffraction grating, the transmissive element having at least one reflective surface for reflecting the plurality of monochromatic optical beams.

46. The device as defined in claim 45, wherein the boot lens is a first boot lens, the device further comprising:

a second boot lens affixed to the transmissive element for transmitting the plurality of monochromatic optical beams from the transmissive element; and

a polymer focusing lens affixed to the second boot lens for focusing the plurality of monochromatic optical beams.

47. The device as defined in claim 46, wherein the boot lens is incorporated into the polymer focusing lens such that the polymer focusing lens is affixed to the transmissive element.

48. The device as defined in claim 46, further comprising:

a third boot lens affixed to the polymer focusing lens for transmitting the plurality of focused, monochromatic optical beams from the polymer focusing lens.

49. The device as defined in claim 48, wherein the third boot lens has a planar exit surface for outputting the plurality of focused, monochromatic optical beams to at least one optical receiver.

50. The device as defined in claim 46, wherein the polymer focusing lens has a planar exit surface for outputting the plurality of focused, monochromatic optical beams to at least one optical receiver.

51. An integrated wavelength division demultiplexing device comprising:

a polymer focusing lens for focusing a plurality of monochromatic optical beams;

a boot lens affixed to the polymer focusing lens for transmitting the plurality of monochromatic optical beams to the polymer focusing lens, the boot lens having a planar entry surface; and

a diffraction grating formed at the planar entry surface of the boot lens for separating a multiplexed, polychromatic optical beam into the plurality of monochromatic optical beams.

52. The device as defined in claim 51, wherein the boot lens is incorporated into the polymer focusing lens such

that the polymer focusing lens has the planar entry surface at which the diffraction grating is formed.

53. The device as defined in claim 51, wherein the diffraction grating is a transmissive diffraction grating.

54. The device as defined in claim 53, further comprising:

a transmissive element associated with the transmissive diffraction grating, the transmissive element having at least one reflective surface for reflecting the multiplexed, polychromatic optical beam toward the transmissive diffraction grating.

55. The device as defined in claim 54, wherein the boot lens is a first boot lens, the device further comprising:

a second boot lens affixed to the transmissive element for transmitting the multiplexed, polychromatic optical beam to the transmissive element; and

a polymer collimating lens affixed to the second boot lens for collimating the multiplexed, polychromatic optical beam prior to transmission by the second boot lens.

56. The device as defined in claim 55, wherein the second boot lens is incorporated into the polymer collimating lens such that the polymer collimating lens is affixed to the transmissive element.